



299-E28-10 (A6789)

Log Data Report

Borehole Information:

| | | | | | |
|-------------------------------------|-------------|--|----------------------------------|-------------------------|-------------|
| Borehole: 299-E28-10 (A6789) | | Site: Northwest of the 216-B-9 Crib | | | |
| Coordinates (WA State Plane) | | GWL (ft): N/A ² | | GWL Date: N/A | |
| North | East | Drill Date | TOC³ Elevation | Total Depth (ft) | Type |
| 136,890.3 m | 573,755.5 m | August 1961 | 207.6 m | 319 | Cable Tool |

Casing Information:

| Casing Type | Stickup (ft) | Outer Diameter (in.) | Inside Diameter (in.) | Thickness (in.) | Top (ft) | Bottom (ft) |
|--------------------|---------------------|-----------------------------|------------------------------|------------------------|-----------------|--------------------|
| Steel Welded | 1.9 | 8.625 | 8.0 | 0.3125 | 0 | 311 |

Borehole Notes:

The logging engineer measured the stickup using a steel tape. A reference point survey "X" is located on top of the casing stickup. Calipers were used to measure the casing wall thickness and the outside diameter; the inside diameter is calculated. Zero reference is the top of casing stickup. Top of casing stickup is cut squarely. HWIS⁴ is the source of the TOC elevation and coordinates. Total depth (ground level reference) and casing bottom (TOC reference) are reported from information provided in Ledgerwood (1993). The borehole was swabbed 03/28/02, and no contamination was detected.

Approximately 5.5 ft west of this borehole, yellow and magenta radiation signs caution that a pipeline is buried nearby. Forty or more radiation signs are aligned north-south marking the pipeline's route that parallels Baltimore Ave. and leads to a vault inside the B Tank Farm.

Logging Equipment Information:

| | | | |
|--------------------------|----------|-------------------------------|------------------------|
| Logging System: | Gamma 2A | Type: | SGLS (35%) |
| Calibration Date: | 11/01/01 | Calibration Reference: | GJO-2002-286-TAR |
| | | Logging Procedure: | MAC-HGLP 1.6.5, Rev. 0 |

Spectral Gamma Logging System (SGLS) Log Run Information:

| Log Run | 1 | 2 | 3 | 4 | 5 |
|-------------------|----------|----------|----------|----------|----------|
| Date | 04/10/02 | 04/11/02 | 04/15/02 | 04/16/02 | 04/17/02 |
| Logging Engineer | Spatz | Spatz | Spatz | Spatz | Spatz |
| Start Depth (ft) | 2.0 | 82.0 | 271.0 | 193.5 | 116.5 |
| Finish Depth (ft) | 26.0 | 25.0 | 192.5 | 115.5 | 81.0 |
| Count Time (sec) | 100 | 100 | 100 | 100 | 100 |
| Live/Real | R | R | R | R | R |
| Shield (Y/N) | N/A | N/A | N/A | N/A | N/A |
| MSA Interval (ft) | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| ft/min | N/A | N/A | N/A | N/A | N/A |
| Pre-Verification | BA126CAB | BA129CAB | BA130CAB | BA131CAB | BA132CAB |
| Start File | BA128000 | BA129000 | BA130000 | BA131000 | BA132000 |

| Log Run | 1 | 2 | 3 | 4 | 5 |
|-------------------------|-----------------------------------|-----------------------------------|-----------------------------------|---|---------------------------|
| Finish File | BA128048 | BA129114 | BA130157 | BA131159 | BA132071 |
| Post-Verification | BA128CAA | BA129CAA | BA130CAA | BA131CAA | BA132CAA |
| Depth Return Error (ft) | 0 | 0 | +0.5" | -0.5" | N/A |
| Comments | Fine-gain adjustment notes below. | Fine-gain adjustment notes below. | Fine-gain adjustment notes below. | Fine-gain adjustment and logging notes below. | No fine-gain adjustments. |

| Log Run | Repeat | | | | |
|-------------------------|---------------------------|--|--|--|--|
| Date | 04/17/02 | | | | |
| Logging Engineer | Spatz | | | | |
| Start Depth (ft) | 29.0 | | | | |
| Finish Depth (ft) | 2.0 | | | | |
| Count Time (sec) | 100 | | | | |
| Live/Real | R | | | | |
| Shield (Y/N) | N/A | | | | |
| MSA Interval (ft) | 0.5 | | | | |
| ft/min | N/A | | | | |
| Pre-Verification | BA132CAB | | | | |
| Start File | BA132072 | | | | |
| Finish File | BA132126 | | | | |
| Post-Verification | BA132CAA | | | | |
| Depth Return Error (ft) | -0.5" | | | | |
| Comments | No fine-gain adjustments. | | | | |

Logging Operation Notes:

Zero reference is the top of casing. Logging was performed with a centralizer installed on the sonde. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT verifier with SN 082.

During the SGLS logging, fine-gain adjustments were necessary to maintain the 1460-keV (⁴⁰K) photopeak at a pre-described channel. During log run one, fine-gain adjustments were made after files BA128000 and -016. On 04/11/02, during log run two, a fine-gain adjustment was made after file BA129046. On 04/15/02, during log run three, a fine-gain adjustment was made after file BA130126. On 04/16/02, during log run four, fine-gain adjustments were made after files BA131023 and -140, and logging was suspended after file BA131011 for computer work. Logging resumed with a 1-ft overlap.

Analysis Notes:

| | | | | | |
|-----------------|---------|--------------|----------|-------------------|------------------------|
| Analyst: | Sobczyk | Date: | 05/28/02 | Reference: | MAC-HGLP 1.6.3, Rev. 0 |
|-----------------|---------|--------------|----------|-------------------|------------------------|

SGLS pre-run and post-run verification spectra were collected at the beginning and end of each day. The verification spectra were all within the control limits except for BA130CAA. The recorded peak counts per second (cps) at the 609-keV, 1461-keV, and 2615-keV photopeaks on the post-run verification spectra as compared to the pre-run verification spectra for each day were within 6 percent of one another at each spectrum's energy line except for BA130CAA. The post-survey verification spectrum for logging run 3 (file BA130CAA) was the only post-survey verification spectrum that was outside of the control limits. The Full Width Half Maximum (FWHM) of the 609-, 1461-, and 2615-keV photopeaks were within the control limits. The peak counts per second for the 2615-keV photopeak was above the upper control limits.

for this post-run verification spectra. Examinations of spectra indicate that the detector appears to have functioned normally during the log run. The post-run verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC Supervisor.

Spectra for the SGLS were processed in batch mode using APTEC Supervisor to identify individual energy peaks and determine count rates. Concentrations were calculated in EXCEL (source file: G2ANov1.xls), using parameters determined from analysis of recent calibration data. Zero reference is the top of the casing. The casing configuration was assumed to be one string of 8-in. casing with a thickness of 0.322 in. to the maximum depth of the log. A casing thickness of 0.322 in. is the published value for ASTM schedule-40 steel pipe (a commonly used casing material at Hanford). This casing thickness is within the range of measurement error associated with the logging engineer's measurements. A water correction was not needed or applied to the SGLS data. Dead time corrections were not needed because dead time did not exceed 10.5 percent.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K , ^{238}U , and ^{232}Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation.

Results and Interpretations:

^{137}Cs was the only man-made radionuclide detected in this borehole. ^{137}Cs was detected near the ground surface (2.0- to 3.0-ft log depth) at activities ranging from 0.5 to 1.3 pCi/g. At 19.0 ft, ^{137}Cs was detected on the repeat log run with an activity near its MDL of about 0.3 pCi/g. Also, a weak 130-keV photopeak was detected 253.0 ft without other confirming peaks for ^{239}Pu .

Recognizable changes in the KUT logs occurred in this borehole. ^{232}Th activities appear to increase by about 0.3 pCi/g in the interval from 162 through 168 ft along with a corresponding increase in total gamma. A decrease of about 3 pCi/g in apparent ^{40}K activities occurs from about 213 through 218 ft. Apparent ^{40}K activities continue to decrease in the interval from about 218 to 240 ft where ^{40}K activities are about 11 pCi/g. The 50-cps increase in total gamma at log depths 245 through 253 ft is attributed to the increase in apparent ^{232}Th and ^{40}K activities in the same interval. In the 200 West Area, a 0.5-pCi/g increase in ^{232}Th and increase in total gamma is characteristic of the Early Palouse Soil; however, the Early Palouse Soil is generally absent in the 200 East Area. Top of Ringold is picked at 253-ft log depth.

The behavior of the ^{238}U log suggests that radon is present inside the borehole casing. This effect is observed in log runs two, three, four, and the repeat (25 to 29 ft). The effects of radon appear to be minimal in the other log runs. Radon daughters such as ^{214}Bi may also "plate" onto the sonde itself. When this occurs, there is a gradual increase in total counts as well as photopeak counts associated with ^{214}Bi and ^{214}Pb . This phenomenon appears to best explain the observed ^{238}U values in log runs three, four, and the repeat. The presence of radon is not an indication of man-made contamination; it is derived from decay of naturally occurring uranium. As a gas, radon moves easily in the subsurface, and concentrations of radon and its associated progeny can change quickly.

Aside from the effects of radon observed on the ^{238}U logs (609 keV and 1764 keV), the plots of the repeat logs demonstrate good repeatability of the SGLS data for the naturally occurring radionuclides. The plots of the repeat logs demonstrate good repeatability of the SGLS data for ^{137}Cs from 2.0 to 3.0 ft. ^{137}Cs was detected on the repeat log run near its MDL and not on the original log run.

References:

Chamness, M.A., and J.K. Merz, 1993. *Hanford Wells*, PNNL-8800, UC-903, Pacific Northwest Laboratory, Richland, Washington.

Ledgerwood, R.K., 1993. *Summaries of Well Construction Data and Field Observations for Existing 200-East Resource Protection Wells*, WHC-SD-ER-TI-007, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

¹ GWL – groundwater level

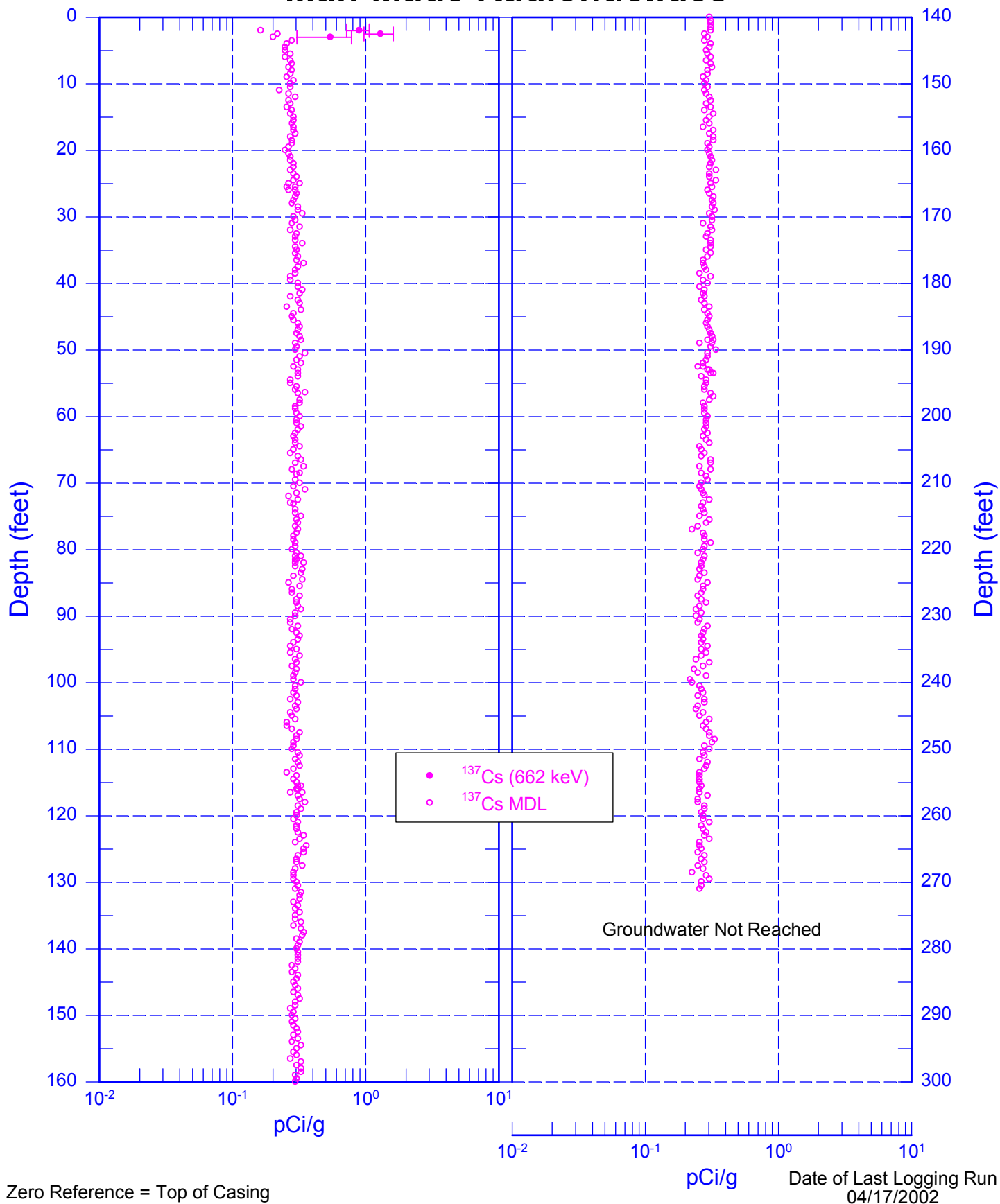
² N/A – not applicable

³ TOC – top of casing

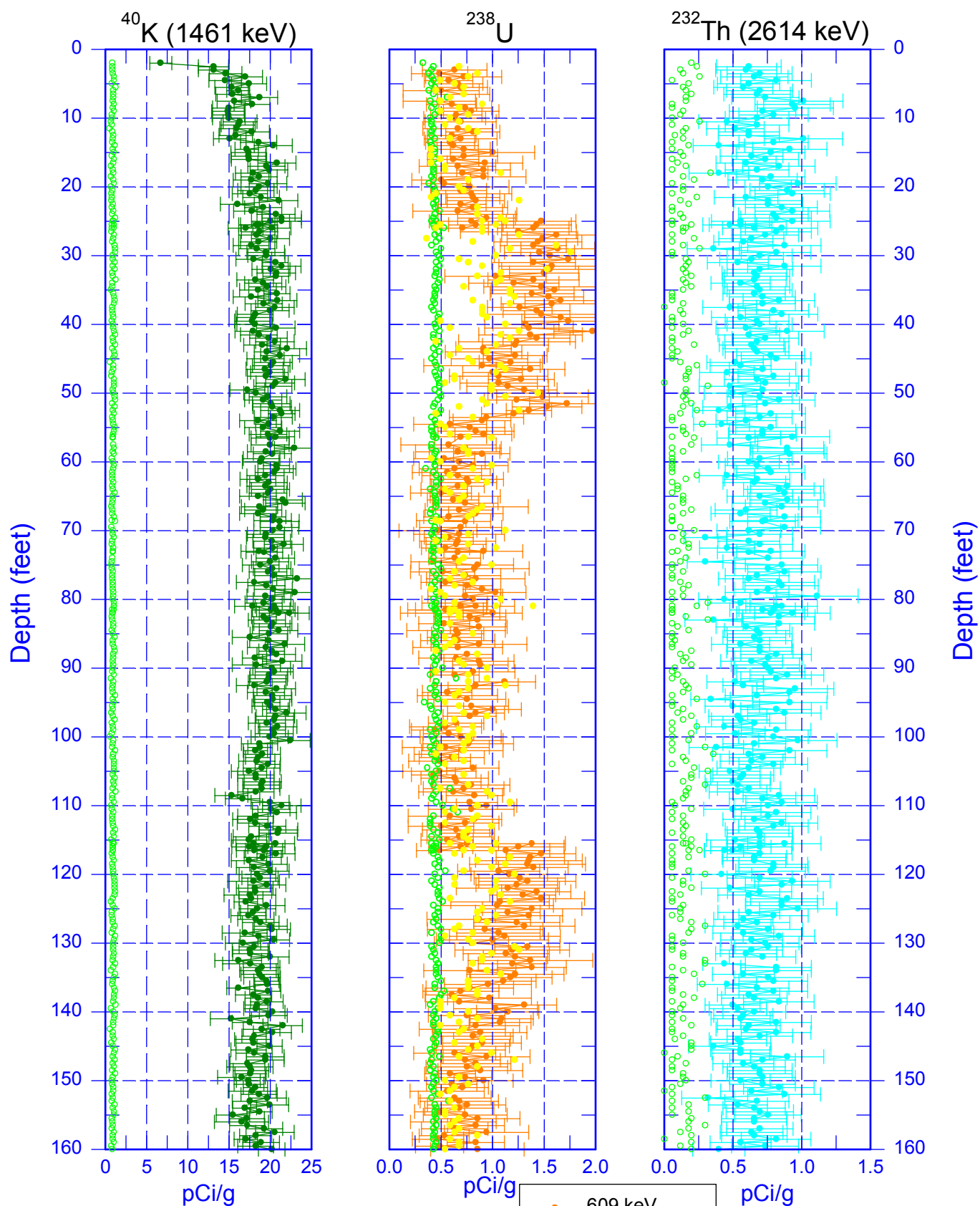
⁴ HWIS – Hanford Well Information System

299-E28-10 (A6789)

Man-Made Radionuclides



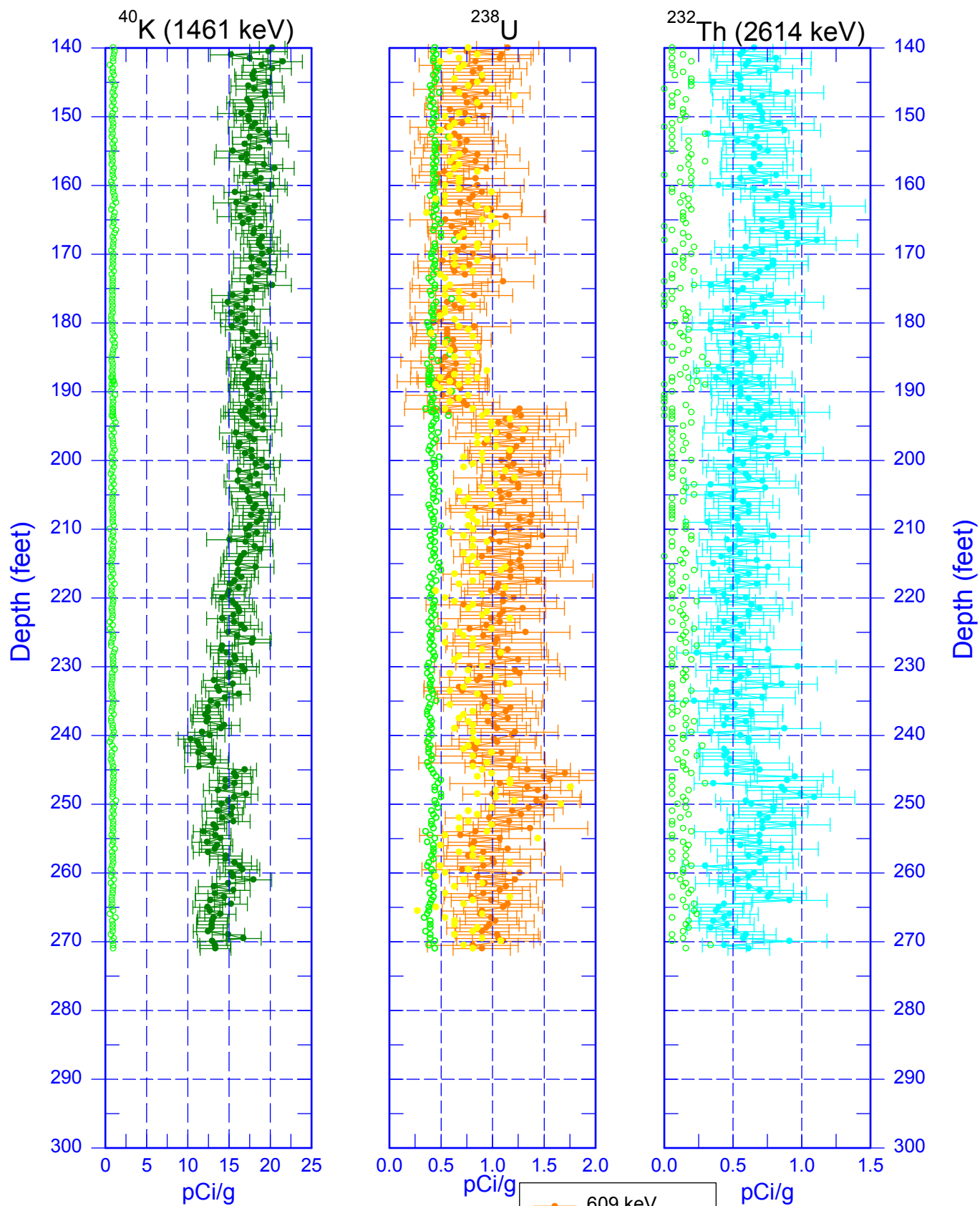
299-E28-10 (A6789) Natural Gamma Logs



Zero Reference = Top of Casing

Date of Last Logging Run
04/17/2002

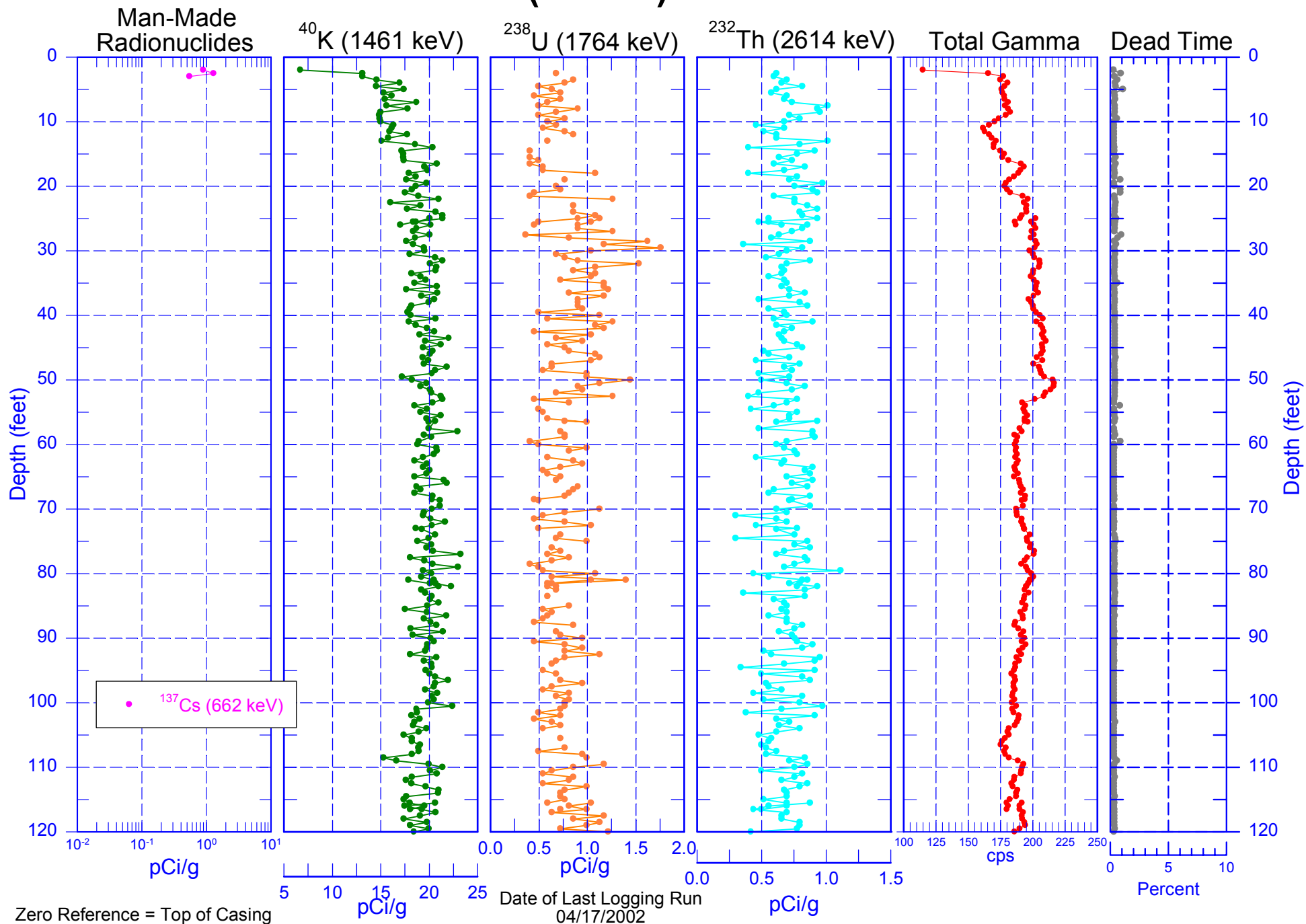
299-E28-10 (A6789) Natural Gamma Logs



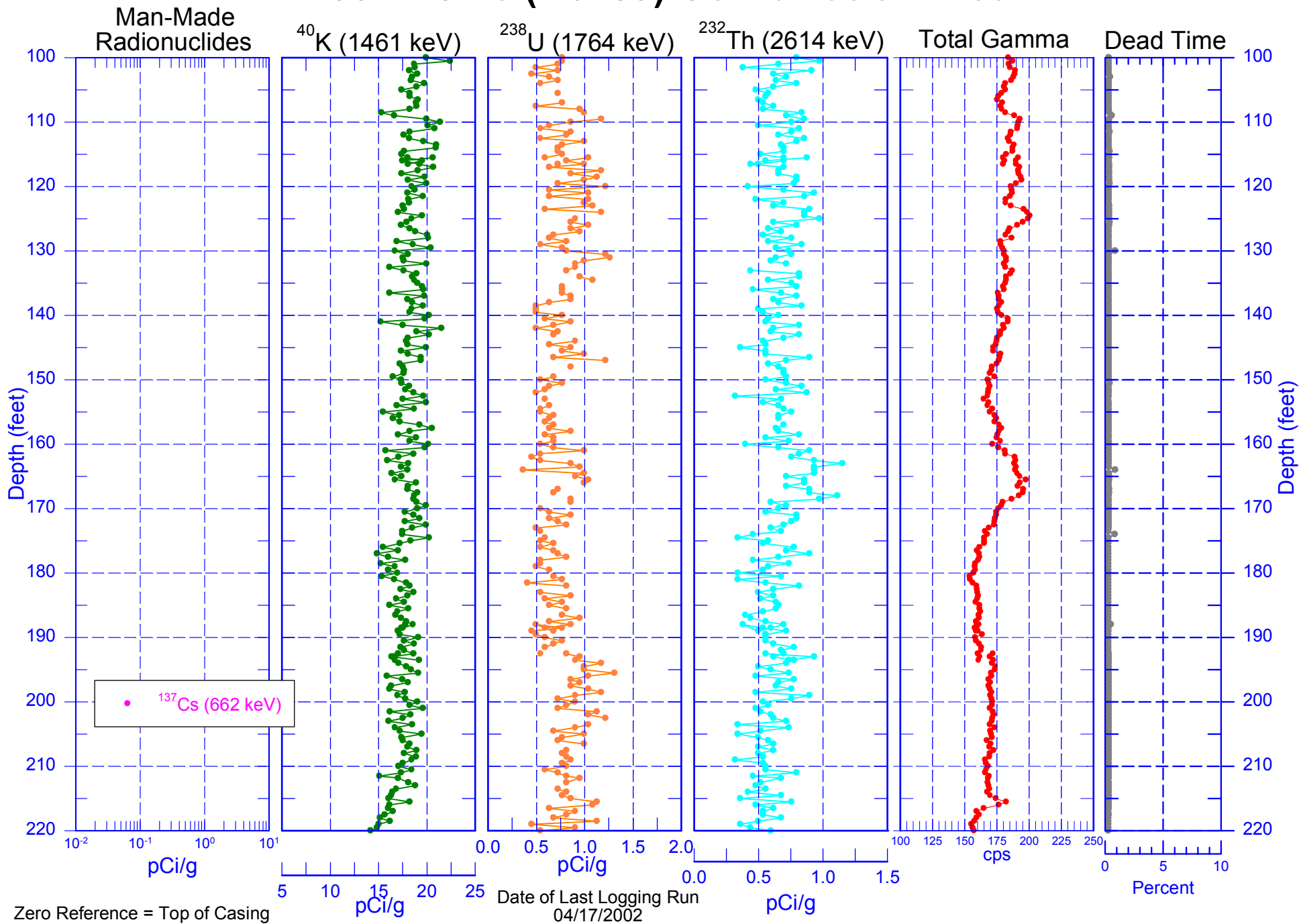
Zero Reference = Top of Casing

Date of Last Logging Run
04/17/2002

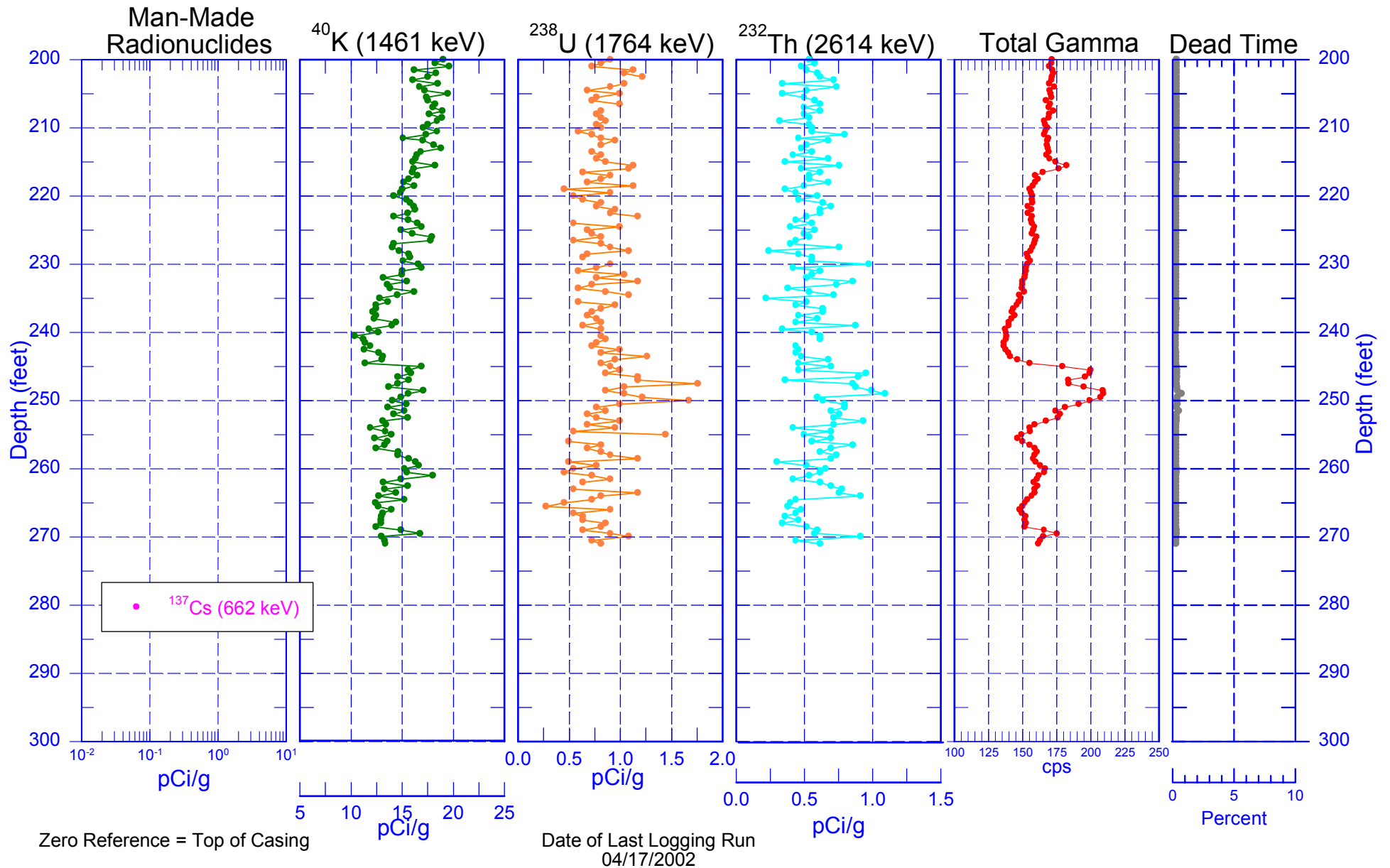
299-E28-10 (A6789) Combination Plot



299-E28-10 (A6789) Combination Plot

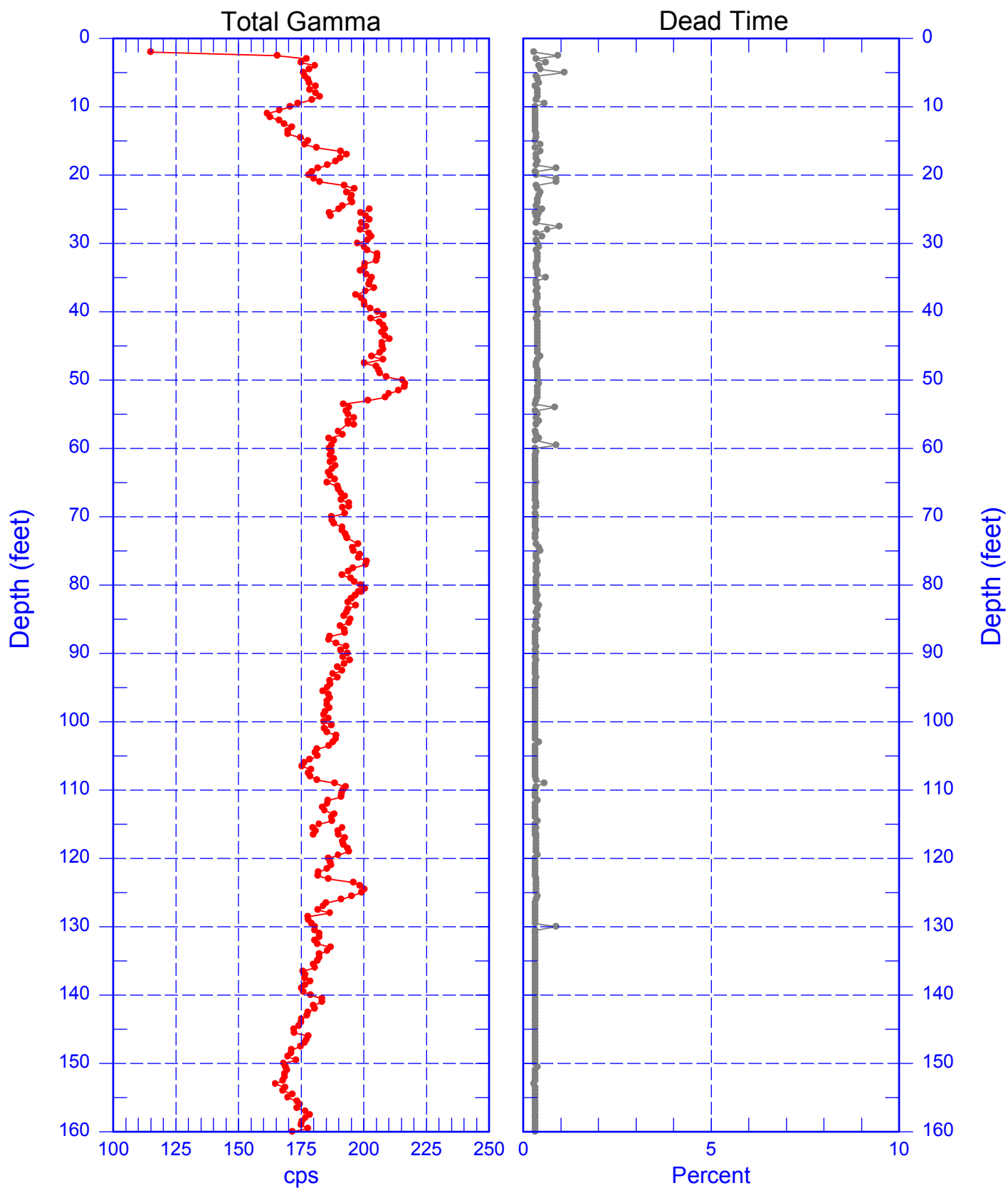


299-E28-10 (A6789) Combination Plot



299-E28-10 (A6789)

Total Gamma & Dead Time

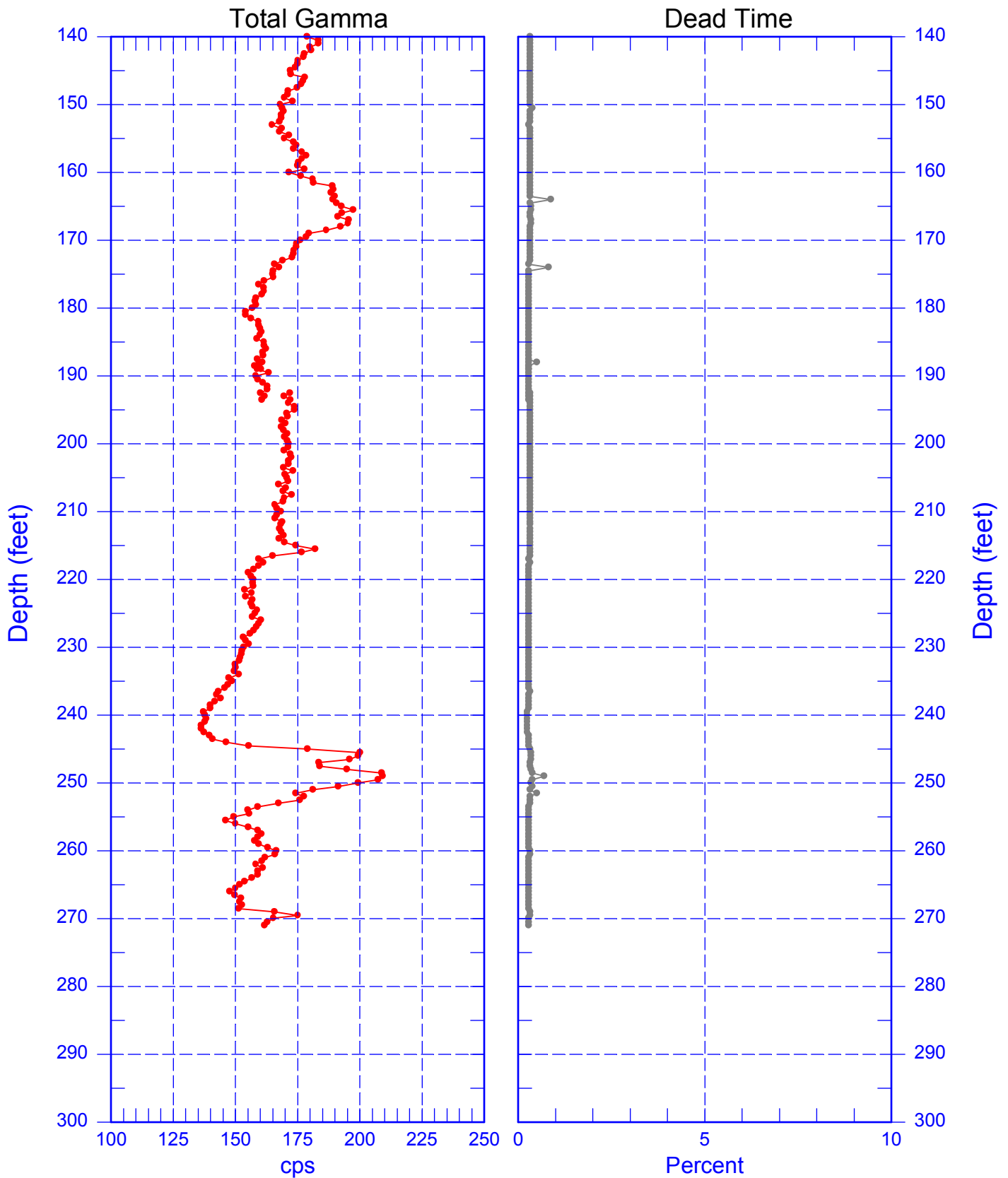


Date of Last Logging Run
04/17/2002

Zero Reference = Top of Casing

299-E28-10 (A6789)

Total Gamma & Dead Time

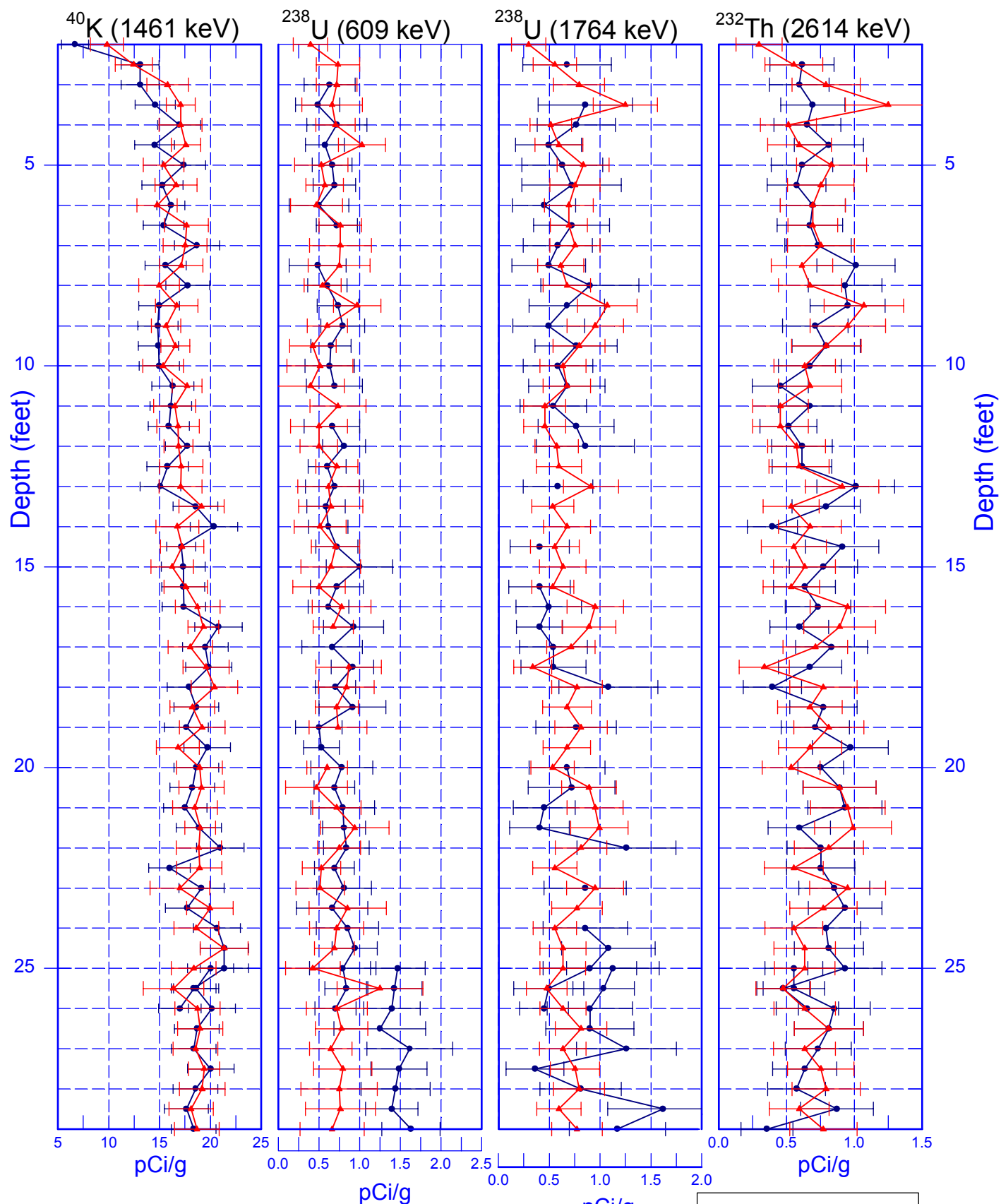


Date of Last Logging Run
04/17/2002

Zero Reference = Top of Casing

299-E28-10 (A6789)

Rerun of Natural Gamma Logs (2.0 to 29.0 ft)



During the original log run (25 to 29 ft), the 609 and 1764 keV photopeak cps are elevated due to radon.

—●— Original Log Run
—▲— Repeat Log Run

299-E28-10 (A6789)

Rerun of Man-Made Radionuclides (2.0 to 29.0 ft)

